The Structural Diagnostic Toolset (TSDT)

Module I - Agency Saturation Calculator

Formal Perimeter Specification

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Abstract

The Agency Saturation Calculator (ASC) is a perimeter module of the Structural Diagnostic Toolset (TSDT) derived from the Relative Framework. It evaluates whether a system retains structurally meaningful agency under constraint, cumulative irreversible information loss, and finite resolution capacity. The module classifies systems as Agentic, Agency-Saturated, or Agency-Collapsed. It does not evaluate intention, preference, morality, or outcomes. It detects structural choice collapse.

1. Design Axioms

A1. All real systems are constrained.
A2. All non-trivial systems experience irreversible information loss.
A3. Agency is defined by the existence of non-forced alternatives.
A4. Resolution capacity is finite.
A5. Choice beyond constraint is undefined, not absent.

Systems violating these axioms fall outside module scope.

2. System Formalisation

$S = (X, C, I, A, K, \rho)$

X - State space
$C \subseteq \wp(X)$ - Constraint sets
$I \subseteq \wp(X)$ - Invariants preserving identity

$A(x) \subseteq X$ - Available action set
$K \in \mathbb{R}\geq 0$ - Cumulative irreversible information loss
$\rho \in \mathbb{R}>0$ - Resolution capacity

If a system cannot be expressed in this form, classification returns UNDEFINED.

3. Effective Action Set

$A_eff(x) = \{ a \in A(x) \mid \chi_I(a) = 1 \text{ and } a \notin C \}$

Actions preserving identity and satisfying constraints.

4. Structural Action Convergence

Let π be an equivalence relation over X induced by outcome indistinguishability.

$\Lambda(x) = | \pi(A_eff(x)) |$

$\Lambda(x)$ measures structurally distinct outcomes available from state x.

5. Irreversibility Condition

$K_\{t+1\} = K_t + \Delta K_t$, where $\Delta K_t \geq 0$.

Lost actionable diversity cannot be recovered without structural reconfiguration.

6. Resolution Capacity

$\rho = \sup \{ \Lambda(x) \mid \exists\, x' \in X \text{ such that } \chi_I(x') = 1 \}$

ρ represents maximum actionable diversity tolerable without collapse.
ρ is fixed during evaluation.

7. Agency Stress Functional

$A_{stress}(x) = (\rho - \Lambda(x) + K) / \rho$

Dimensionless, monotonic, unbounded above.

8. Classification Mapping

$A_{stress}(x) < 1 \rightarrow$ AGENTIC
$A_{stress}(x) = 1 \rightarrow$ AGENCY-SATURATED
$A_{stress}(x) > 1 \rightarrow$ AGENCY-COLLAPSED

Outputs are mutually exclusive and exhaustive.

9. Operational Procedure

1. Define system and action space.
2. Specify constraints and invariants.
3. Identify available actions.
4. Estimate K.
5. Compute or bound $\Lambda(x)$.
6. Evaluate $A_{stress}(x)$.
7. Return classification.

No intervention recommendations.

10. Interpretation Constraints

AGENTIC does not imply freedom or desirability.
AGENCY-SATURATED does not specify which alternative fails.
AGENCY-COLLAPSED indicates forced motion without meaningful choice.

11. Scope

Detects:
- Choice collapse
- Forced decision regimes
- Loss of actionable alternatives

Does not predict:
- Behaviour
- Preferences
- Outcomes

12. Structural Integration Statement

Under admissible divergence, monotonic irreversibility, finite resolution capacity, and invariant preservation, the Agency Saturation Calculator constitutes a deterministic perimeter divergence module within TSDT.

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